



Elementary school practices and children's objectively measured physical activity during school[☆]



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ARTICLE INFO

Available online 12 August 2013

Keywords:

Accelerometry
Physical education
Policy
Recess

ABSTRACT

Objective. To examine the relation of physical activity practices covering physical education (PE), recess, and classroom time in elementary schools to children's objectively measured physical activity during school.

Methods. Participants were 172 children from 97 elementary schools in the San Diego, CA and Seattle, WA USA regions recruited in 2009–2010. Children's moderate-to-vigorous physical activity (MVPA) during school was assessed via accelerometry, and school practices were assessed via survey of school informants. Multivariate linear mixed models were adjusted for participant demographics and unstandardized regression coefficients are reported. The 5 practices with the strongest associations with physical activity were combined into an index to investigate additive effects of these practices on children's MVPA.

Results. Providing ≥ 100 min/week of PE ($B = 6.7$ more min/day; $p = .049$), having ≤ 75 students/supervisor in recess ($B = 6.4$ fewer min/day; $p = .031$), and having a PE teacher ($B = 5.8$ more min/day; $p = .089$) were related to children's MVPA during school. Children at schools with 4 of the 5 practices in the index had 20 more min/day of MVPA during school than children at schools with 0 or 1 of the 5 practices ($p < .001$).

Conclusions. The presence of multiple school physical activity practices doubled children's physical activity during school.

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Schools are recommended to provide physical activity opportunities to contribute to children meeting the 60 min/day moderate-to-vigorous physical activity (MVPA) guideline (CDC, 2011; Koplan et al., 2005; Pate et al., 2006; USDHHS, 2008). Recommendations for elementary schools are to provide children with ≥ 30 min/day of MVPA through Physical Education (PE), recess and other opportunities. Recommendations are ≥ 20 min of recess/day, ≥ 150 min of PE/week, and $\geq 50\%$ of PE time be spent in MVPA (CDC, 2011; Koplan et al., 2005; Pate et al., 2006). However, few U.S. public schools report meeting the PE recommendations, and approximately two thirds report meeting recess recommendations (Turner et al., 2010).

Previous studies have found that children's physical activity during school is related to the characteristics of the physical environment, such as availability and condition of gymnasium facilities (Sallis et al., 2001). School physical activity practices, which represent a direct

measure of the opportunities that schools provide for physical activity, regardless of formal and informal policies, have been less studied. Evidence supports school practices such as active PE (e.g., SPARK) (McKenzie et al., 1996; Sallis et al., 1997) and classroom physical activity breaks (Donnelly et al., 2009; Mahar et al., 2006), but studies have typically examined single interventions (e.g., PE), rather than multiple practices. Survey studies have described school practices such as minutes allocated for PE and recess (Lee et al., 2007; Turner et al., 2010), but seldom have these practices been investigated relative to children's physical activity.

The purpose of the present study was to investigate the relation of existing school physical activity practices covering PE, recess and classroom activities, to children's objectively measured physical activity during school. It was hypothesized that children who attended schools with more practices supportive of physical activity, particularly those related to PE and recess, would accumulate more minutes/day of MVPA.

Methods

Study design and participants

Participants were children enrolled in the Neighborhood Impact on Kids (NIK) and MOVE studies. NIK was a longitudinal observational study that

[☆] Funding for this study was from NIH ES014240, NIH DK072994, NIH T32 HL79891, and The California Endowment.

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investigated the relation of neighborhood built environment attributes to physical activity, nutrition, and obesity and included 723 children. The children were aged 8–13 years at 2-year follow-up, which was the assessment period used in the present study. Participants were recruited by telephone from selected neighborhoods in the Seattle/King County, WA and San Diego County, CA USA metropolitan areas (Saelens et al., 2012).

MOVE was a recreation center-based obesity prevention program that included 541 children from San Diego County, CA USA (Elder et al., 2013). Children were aged 8–11 years at the 2-year follow-up, the assessment period used in the present study. Recruitment occurred around 30 public recreation centers using phone calls, flyers, presentations, and staffed information booths. The MOVE obesity prevention program included educational sessions at recreation centers and did not target schools or physical activity during school. The MOVE obesity prevention program did not significantly increase children's MVPA (Elder et al., 2013).

Exclusion criteria for the NIK and MOVE studies were similar: having a medical and/or psychological condition that affected diet, physical activity, growth or weight; and not being able to read and speak English or Spanish. There were no BMI criteria for enrollment. Child physical activity data for the present study were from NIK and MOVE assessments conducted during the 2009–2010 school year. Consent was obtained from parents and assent from children, and both studies were approved by the sponsoring universities' Institutional Review Boards. The authors have no conflicts of interest to declare.

Some children completed the accelerometer assessment (main study outcome) when school was not in session (e.g., summer, holiday), so accelerometer data from days when school was not in session were excluded from the present analyses.

School informants

During the spring of 2012, PE teachers, or principals when there was no PE teacher, from the elementary schools attended by NIK and MOVE participants were contacted to complete a questionnaire assessing their school practices about physical activity. The focus of the present study was elementary school-aged youth, so middle schools were excluded. Prior to contacting school informants, school district officials were contacted to request permission to contact individual schools. Approval was obtained from 25 of the 28 districts contacted; the 3 districts that declined to participate were large districts in San Diego County.

Final study sample

Overall, NIK and MOVE included 1264 participants. After excluding middle schools, participants who completed assessments when school was not in session, and schools within the 3 San Diego districts that declined to participate, the potential sample size for the present study was 297 child participants from 154 schools. Complete survey responses were received from 63% of the informants contacted, resulting in a final sample size of 172 child participants from 97 schools.

Measures

Children's physical activity

Participants wore waist-worn Actigraph accelerometers, which have good validity for assessing physical activity in children (Welk et al., 2000). Instructions were to wear the device for 7 days during all waking hours. NIK used Actigraph model GT1M and MOVE used Actigraph models 7164 and GT1M, all set to record acceleration at 30-second epochs. Minutes of physical activity were calculated using the 4-MET Freedson age-based thresholds (Freedson et al., 2005) which have been used for national prevalence estimates (Troiano et al., 2008). Weekend days were excluded, and school start and end times unique to each individual school were used to calculate minutes/day of MVPA during school, thus eliminating non-school time from the analysis. Days with any nonwear time during school were removed from the analysis, with nonwear time defined as ≥ 20 min of consecutive 0 counts.

Children's demographic characteristics

Parents reported their highest education level attained and their child's school name, grade level, gender, and race/ethnicity.

School demographic characteristics

State Department of Education data were used to identify each school's percent of students that were white non-Hispanic and percent eligible for free or

reduced-price lunch, as well as the total number of teachers and students (California Department of Education, 2012; State of Washington, 2012).

School physical activity practices

The school physical activity practice items were selected from the School Physical Activity Policy Assessment (S-PAPA) tool (Lounsbury et al., 2013), and some adaptations were made. The survey was kept brief to limit burden and increase participation; items relevant to PE, recess, and classroom physical activity that were expected to have the largest reach and associations with physical activity were retained. The practices assessed included whether 1) the school had a PE teacher (could include a PE aide), 2) training was provided to increase MVPA in PE, 3) recess was supervised by a classroom teacher, 4) organized activities (e.g., walking programs, games) were provided during recess, 5) classroom teachers were provided training on classroom physical activity breaks, and 6) classroom teachers implemented classroom physical activity breaks. Informants also reported the 7) number of minutes/PE lesson and 8) number of lessons/week of PE, 9) number of students/PE lesson, 10) average length of recess periods, and 11) average number of students/supervisor during recess. In schools without a PE teacher, classroom teachers were responsible for holding PE. The minutes/PE lesson item was multiplied by the number of PE lessons/week item to determine number of PE minutes/week. Because state laws (California State Board of Education, 1999; National Cancer Institute, 2011) and formal guidelines (CDC, 2011; National Association for Sport and Physical Education, 2012; Pate et al., 2006) exist for PE minutes/week and recess minutes/day, these variables were dichotomized as ≥ 100 min/week for PE (the mandated amount in California and Washington) and ≥ 20 min/period for recess. The PE class size and recess students/teacher items were explored as continuous and dichotomous variables (different cut points were tested), and the stronger correlates of during-school MVPA were retained in the analysis.

School informants were instructed to consider 5th grade classes when responding to the survey questions, because this was the average grade of the children in the study sample. Informants were also instructed to consider the 2009–2010 school year when completing the survey and were asked if they were working for their current school during 2009–2010.

Analyses

Spearman correlations were used to investigate relationships among the physical activity practices. A three-level mixed effects linear regression model was used to investigate the relation of school practices to children's min/day of MVPA during school (model 1). Days of accelerometer monitoring within participants were used as a level of analysis, in addition to participants within schools, to improve study power, rather than averaging MVPA across days within a participant. A school physical activity practice index was derived to represent the number of practices each school reported from a list of practices that had an effect size $>|2.5|$ min/day of MVPA in model 1. School practices with effect sizes $>|2.5|$ in model 1 were considered to be important to children's physical activity, and the purpose of the index was to explore if there were additive rather than substitutive effects of having multiple school physical activity practices. A second three-level mixed effects linear regression model was used to investigate the relation of the school practices index to children's MVPA during school (model 2). Both models adjusted for child age, gender, accelerometer model, study, and intervention condition (for MOVE participants). All independent variables and covariates were centered on zero (i.e., 0.5 vs. -0.5) with the exception of age which was grand mean centered. Unstandardized coefficients were reported and can be interpreted as min/day of MVPA.

Results

Table 1 presents the characteristics of the child participants and elementary schools in the final study sample. BMI, race/ethnicity and parent education for the subsample used in the present study were within 5% of the overall samples that were part of NIK and MOVE, with the exception that the overall MOVE sample had 7% more Latinos than the present subsample. Table 2 presents the percent of schools with each practice and the correlations among the practices. Schools reported providing an average of 81.4 (SD = 42.6) min/week of PE and 19.4 (SD = 4.2) min/period of recess. There were an average of 38.9 (SD = 63.7) students/lesson in PE and 69.1 (SD = 40.7) students/supervisor in recess.

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